



American Peregrine Falcon (*Falco peregrinus anatum*) Monitoring along the Upper Yukon River in Yukon-Charley Rivers National Preserve, Central Alaska Network: 2008 Report

Natural Resource Report NPS/CAKN/NRTR—2008/138



ON THE COVER

View from the Peregrine Falcon territory, 21-Mile, overlooking the Upper Yukon River in Yukon-Charley Rivers National Preserve, Alaska, May 2008. Photograph by: Chris Florian, Sandhill Company, Utah.

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Executive Summary

American peregrine falcons along the upper Yukon River, including Yukon-Charley Rivers National Preserve (YUCH), Alaska, have been monitored almost continuously since 1973. This and other local populations in interior Alaska have increased steadily since the late 1970s, following the ban of DDT in the United States in 1972, and their listing as endangered in 1973 under the Endangered Species Act (U.S. Congress). In August 1999, the U.S. Fish and Wildlife Service (USFWS) removed the American peregrine falcon from the list of Threatened and Endangered Wildlife. Section 4(g)(1) of the Endangered Species Act requires that all species which have recovered and have been removed from the list are monitored for not less than five years following delisting. In 2004, the last year of this five-year monitoring program was implemented by the Air Force, USFWS, and National Park Service (NPS). In 2003, the upper Yukon River peregrine falcon population was identified as one of two index populations in Alaska for long-term monitoring beyond 2004 (USFWS 2003), and in 2005 by the Central Alaska Network (as part of the NPS Vital Signs Inventory and Monitoring Program) as an important vital sign in determining ecosystem health (MacCluskie and Oakley 2005). A monitoring protocol was prepared (Ambrose et al. 2005) following standards of Oakley et al. (2003), which is currently in the peer review process.

In 2008, 265 kilometers of the upper Yukon River were surveyed. Fifty-two nesting territories were occupied by American peregrine falcons (50 pairs and 2 single adults on territories). Thirty-five of 52 pairs (70.0%) were successful, and produced 79 nestlings. Productivity was 1.58 nestlings per total pair and 2.26 nestlings per successful (≥ 1 nestling observed) pair. Between 1975 and 2008, the number of total and successful pairs nesting along the upper Yukon River has been steadily increasing, though the percentage of total pairs nesting successfully has been declining. This may be attributable to increased competition for resources due to increased density. In 2008, four new territories were established on cliffs not previously used by peregrines in over 30 years of observations. Pairs of peregrines occupied new territories on Simon Bluff (YUKO 24.0), Upper Biederman Bluff (YUKO 148.0), Woodchopper + 2 km (YUKO 189.0) and Webber Creek-Middle (YUKO 199.5).

Recent contaminants analyses of Peregrine Falcon eggs from YUCH suggest that mercury is currently at levels that may affect reproduction, and trends suggest that mercury levels may be increasing (Ambrose et al. 2000). Mercury is a persistent compound which bioaccumulates at high trophic levels causing toxic effects (similar to DDT). Additionally, DDT and other pesticides are still being used in wintering grounds, which may cause continued risk to the population. In response to these threats, addled eggs and samples of nestling feathers are collected to determine contaminants levels on the nesting grounds. Molted adult feathers are collected to assess contaminants levels on the wintering grounds. In 2008, one addled egg was collected from the Takoma Creek (YUKO 208.5) eyrie site. When possible, samples of nestling and molted adult feathers, buccal swabs (Handel et al. 2006) and egg-shell fragments are collected for genetic comparison of the upper Yukon River population to other North American peregrine populations.

Introduction

American peregrine falcons (*Falco peregrinus anatum*) are medium-sized raptors that prey almost entirely on birds. Their breeding range extends from Mexico north to the tree-line in Canada and Alaska. In Alaska, they occur in the forested interior, nesting primarily on cliffs along the major rivers. In the northern parts of its range, the American peregrine falcon is highly migratory, wintering as far south as Brazil and Argentina.

Beginning in the late 1940s, the use of persistent organochlorine pesticides greatly affected American peregrine falcons in North America. These pesticides affected mortality and behavior, and caused birds to lay thin-shelled eggs that often failed to hatch and consequently lowered productivity. American peregrine falcons were classified as endangered in 1973 under the Endangered Species Act (U.S. Congress). In interior Alaska, American peregrine falcons declined to approximately 20 percent of historical levels by the mid-1970s. In 1972, the United States restricted the use of persistent organochlorine pesticides, and since 1978, American peregrine falcons in interior Alaska have been increasing.

Though population numbers have increased, recent evidence suggests that American peregrine falcons are still threatened by environmental contaminants. Analyses of American peregrine falcon eggs from the upper Yukon River suggest that mercury, a persistent compound which bioaccumulates at high trophic levels causing toxic effects (similar to DDT), is currently at levels that may affect reproduction, and trends suggest that mercury levels may be increasing (Ambrose et al. 2000). High levels of mercury are made biologically available through industrial processes such as mining and waste incineration, and will likely increase with global industrialization. Additionally, DDT and other pesticides are still being used on wintering grounds, which may cause continued risk to the population.

American peregrine falcons in the upper Yukon River corridor, within and adjacent to Yukon-Charley Rivers National Preserve (YUCH), have been identified by the National Park Service (NPS) as an important vital sign within the Central Alaska Inventory and Monitoring Network (CAKN). *Fauna Distribution and Abundance* was identified as one of CAKN's highest priority vital signs. American peregrine falcons were specifically identified because they are top trophic level predators that are indicators of persistent bioaccumulative contaminants (MacCluskie et al. 2005). Additionally, along with the Tanana River, the upper Yukon River study area was identified as an index area for Alaska in the National *Monitoring Plan for the American Peregrine Falcon* (USFWS 2003). A monitoring protocol which incorporates national and network objectives was prepared (Ambrose et al. 2005) following standards of Oakley et al. (2003), which is currently in the peer review process.

The upper Yukon River, from the Alaska – Yukon Territory border to Circle, Alaska, provides excellent cliff-nesting habitat for American peregrine falcons as well as an abundant variety of prey species. The majority of this habitat lies within YUCH, with American peregrine falcon protection being one of the primary reasons for the Preserve's establishment in 1980 (U.S. Congress). The enabling legislation establishing YUCH, the Alaska National Interest Lands Conservation Act (U.S. Congress 1980), states:

“the preserve shall be managed for the following purposes... to protect habitat for, and populations of, fish and wildlife, including but not limited to peregrine falcons and other raptorial birds, ...”

The American peregrine falcon population breeding within the upper Yukon River valley is believed to be one of the best studied populations in North America. Over 30 years of data document the population’s recovery from 11 pairs in 1973 (Ritchie 1976) to 52 pairs in 2004 and 2008 (Guldager et al. 2005, Ambrose et al. 2008). The number of total pairs nesting along the upper Yukon River has been steadily increasing, although the percentage of total pairs nesting successfully has been declining. This may be attributable to increased competition for resources due to increased density. Further monitoring is necessary to understand the natural variation of a “healthy” American peregrine falcon population, which will allow us to later detect population change that is beyond normal limits of variation.

One important aspect of the American peregrine falcon population in Yukon-Charley Rivers National Preserve is that this population has never been manipulated. Nest manipulations, captive breeding, releases, and take for harvest have never occurred there. In all other populations in the lower-48 states, there have been influences of these manipulations and captive-breed releases. Hence, the upper Yukon River population is unique for this subspecies as one where the recovery has been completely natural and well studied.

Surveys for American peregrine falcons along the upper Yukon River (between Circle, Alaska and the Alaska – Yukon Territory border) have been conducted annually since 1973 by Skip Ambrose. He has collected most of the data (over 95%) in the current data set over these many years and has expertise and intimate knowledge of the study area and these raptors. To ensure that survey results are comparable to previous years, Skip Ambrose assisted with the field surveys and data entry. Observations, survey and productivity data for most of these surveys were recorded each survey year on the Alaska Raptor Nest Record (USFWS 1989), a field survey form developed in 1989 and most recently revised in 2006. All nest card data (1973-2008) are now entered into the new Peregrine database developed by CAKN. The new peregrine database was tested in 2008 and modifications are being made by the CAKN data managers to make the database more efficient for both field data entry and historical data entry. The new database has fields that match the revised Alaska Raptor Nest Card, and all digital historical data (including photos, notes, maps of territories and eyries information) will be entered after final modifications are made to the database.

Objectives

The three primary objectives for the American peregrine falcon monitoring program in the upper Yukon River study area are:

1. To monitor temporal trends in the breeding performance of American peregrine falcons within YUCH. This includes annual measures of territory occupancy, nest success and productivity.

2. To monitor levels of contaminants in eggs produced by American peregrine falcons breeding in YUCH. This includes repeated analyses of eggs for persistent organic pollutants (e.g. DDT and polychlorinated biphenyls (PCBs) and heavy metals (e.g. mercury and cadmium); contaminants found in eggs reflect contaminants that the birds were exposed to at wintering grounds and along migration routes.

3. To monitor levels of contaminants accumulated in feathers of nestling American peregrine falcons on the breeding grounds within YUCH. This includes repeated analyses of nestling feathers for heavy metals (e.g. mercury and cadmium); contaminants found in nestling feathers reflect natal area contaminants exposure.

Methods

Site Selection

The study area is located on a section of the Yukon River between the Alaska – Yukon Territory border and Circle, Alaska, a distance of 265 km (165 miles). The study area is limited to 0.5 km on either side of the river (Figure 1). The river elevation varies from 260 m (865 ft) above sea level at the Alaska – Yukon Territory border to 170 m (560 ft) at Circle, Alaska. Cliffs, rock outcrops, and dirt banks are common along the river, ranging from 8 m to 600 m above the river. The area's diverse topography, frequent wildfires, discontinuous permafrost, and climate interact to create a complex mosaic of taiga and tundra within the subarctic boreal forest zone (NPS 1993). Spruce/hardwood forest, wet meadows, tussock tundra, shrub thickets, and sparsely vegetated gravel bars dominate. Black spruce (*Picea mariana*) forest occurs in poorly drained areas on north facing slopes, low terraces and floodplains. White spruce (*P. glauca*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and/or balsam poplar (*P. balsamifera*) are common at well drained sites along riparian areas, steep drainages, and south facing slopes.

Methodology

Refer to the *American Peregrine Falcon Monitoring Protocol for Yukon-Charley Rivers National Preserve* (Ambrose et al. 2005) prepared for the CAKN Monitoring Program, NPS, for a detailed description of methods.

Twenty-four days were spent in the study area in 2008 performing peregrine monitoring surveys, 22 May to 1 June, 28 June to 7 July, and 9 to 10 July. The early survey (mid- to late-May) located occupied nesting territories; the second survey in July determined breeding success and productivity. Skip Ambrose and Chris Florian also were on the Yukon River conducting passerine research between the two surveys periods. During this time (June 7 to June 18), they checked 18 peregrine territories, adding 12 days to the survey effort for 2008 beyond that prescribed in the protocol. Surveys were conducted using a 21-ft river boat launched from Circle or Eagle, Alaska. Usually for each field visit, the field crew motored up the river from Circle, Alaska to the Alaska – Yukon Territory border, and returned to Circle. However, in May of 2008, massive chunks of river ice accumulated near the boat launch in Circle preventing access to the river. Consequently, the early survey had to be launched from Eagle and the crew traveled downriver from the Yukon Territory border to Circle for the duration of the survey. During the first survey, all potential nesting territories along the river were observed from shoreline or islands using binoculars and spotting scopes. Observations were conducted for a minimum of 4 hours at each potential nesting territory, unless occupancy could be confirmed sooner. When possible, campsites were chosen for their proximity to potential nesting territories to extend survey periods. During the second survey in July, all occupied territories were observed using binoculars and spotting scopes to determine the number and age of nestlings. In May, the survey was conducted by a crew of 3 (Ambrose, Florian and Burch). The July survey was conducted by a crew of 2 (Ambrose and Florian) and John Burch checked a few additional eyries for productivity on 9 and 10 July. See Table 1 for a list of participants.

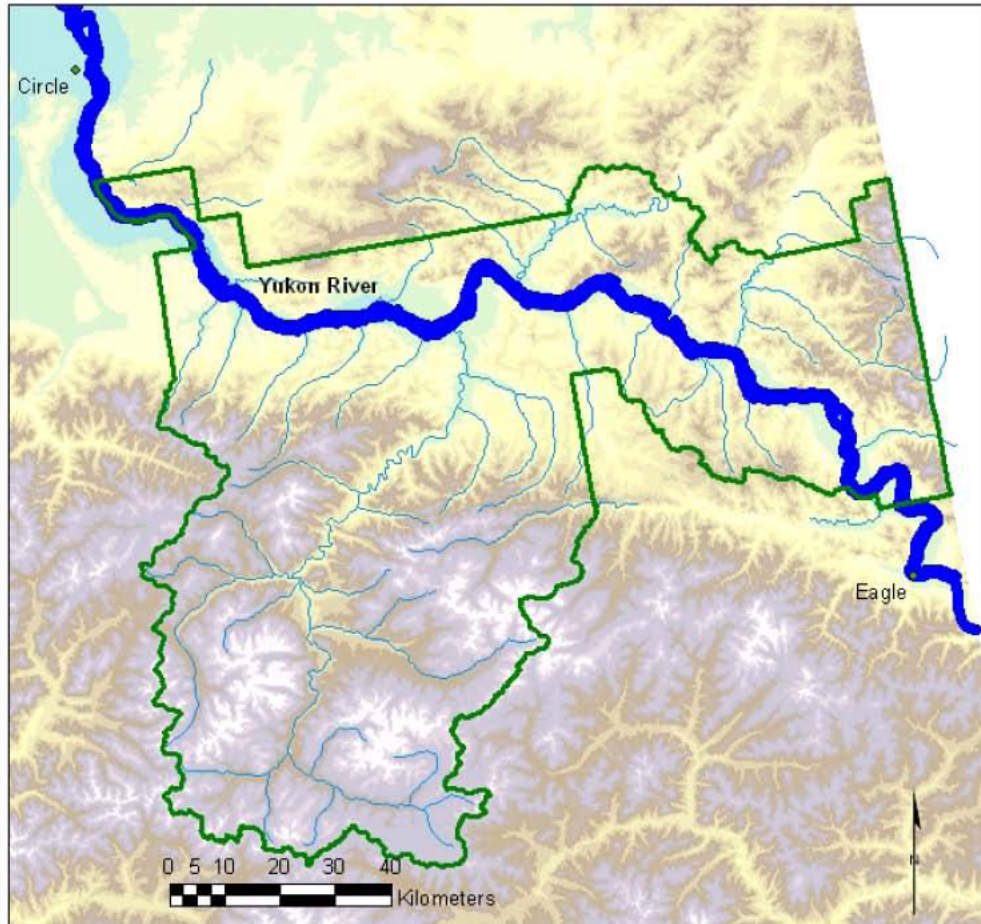


Figure 1. The Upper Yukon study area includes all available habitat within 1.0 km of the section of the Yukon River between the Alaska – Yukon Territory border and Circle, Alaska. Yukon-Charley Rivers National Preserve, Alaska, is outlined in green.

Table 1. Field crew members, their affiliations, and dates in the field, 2008. The * indicates additional observation time beyond that prescribed in the field protocol (see text for details).

Crew Member	Affiliation	Dates in Field
Skip Ambrose	Wildlife Biologist, Sandhill Company, Utah	22 May –1 June
		*7 June –18 June
		28 June – 7 July
Chris Florian	Wildlife Biologist, Sandhill Company, Utah	22 May –1 June
		*7 June –18 June
		28 June – 7 July
John Burch	Wildlife Biologist, Yukon-Charley Rivers National Preserve, NPS	22 May –1 June
		9 July – 10 July

Nesting territories were noted on U.S. Geological Survey topographic maps (1:63,360), and latitude and longitude from GPS units were recorded for new territories. Nest occupancy data and nest site characteristics were entered onto Alaska Raptor Observation Record Cards (USFWS 1989, updated 2006) and then into the new peregrine database. Narrative descriptions of behavior, nest site locations, and other observations were kept in field notebooks.

Terminology and definitions followed that described in the National Wildlife Federation’s Raptor Management Techniques Manual (1987) (Appendix I).

The following information was collected:

1. Number of nesting territories occupied by a pair;
2. Number of nesting territories occupied by a single adult;
3. Number of pairs attempting to breed;
4. Number of pairs with nestlings;
5. Number of nestlings reaching 2 to 4 weeks of age; and
6. Estimated Age of nestlings at time of nest visit.

Nesting phenology was calculated based on 7 days for clutch completion, 33 days for incubation (with incubation beginning after the third egg), and 40 days from hatching to first flight (Cade et al. 1996). Ages of nestlings were estimated during nest visits using photographs of known-age nestlings (Cade et al. 1996).

The following nest site information was collected for each new occupied eyrie and/or territory (previously used sites were documented in past years):

1. Cliff height (primary rock surface area, m);
2. Cliff height above river (talus slope or forested area below cliff, m);
3. Cliff length (km);
4. Nest height on cliff (relative to rock surface area, m); and
5. Nest height above river (m).

Results

Fifty-two nesting territories were occupied by American peregrine falcons along the upper Yukon River in 2008 (50 pairs and 2 single adults on territories). Extra adults were observed at 6 territories occupied by pairs. Thirty-five of the 50 pairs (70.0%) were successful, and produced 79 nestlings in 2008. Productivity was 1.58 nestlings per total pairs and 2.26 nestlings per successful pair (Tables 2 and 3 and Figures 2 and 3). In 2008, one addled egg was collected from the Takoma Creek (YUKO 208.5) eyrie site. Also, four new territories were established on cliffs not previously used by peregrines in over 30 years of observations. Pairs of peregrines occupied new territories on Simon Bluff (YUKO 34.0), Upper Biederman Bluff (YUKO 148.0), Woodchopper + 2 km (YUKO 189.0) and Webber Creek-Middle (YUKO 199.5) (Table 2).

Table 2. American peregrine falcon adults and nestlings observed by territory along the Upper Yukon River, Alaska, in 2008. Newly established territories in 2008 are denoted by an *. One addled egg was collected from Takoma Creek (YUKO 208.5).

KM	Name (Local Description)	Adults	Nest.	KM	Name (Local Description)	Adults	Nest.
YUKO004.0	Border + 4.0 km	2	0	YUKO166.0	Sam Creek	1	0
YUKO009.5	Eagle Creek	2	0	YUKO176.5	Coal Creek -1.0 km	2	2
YUKO014.0	Eagle Village	2	0	YUKO180.0	McGregor's Cabin	2	2
YUKO020.0	Eagle Bluff	3	1	YUKO181.5	Edward's Creek	2	2
YUKO025.0	Boulder Creek - .1.0 km	2	3	YUKO184.0	McGregors + 3 km	2	3
YUKO031.5	Shade Creek - 1.5 km	2	3	YUKO187.0	Woodchopper Creek	2	3
YUKO034.0	Simon Bluff*	3	0	YUKO189.0	Woodchopper + 2 km*	2	0
YUKO038.0	Calico Bluff	3	3	YUKO192.0	Woodchopper + 5 km	2	2
YUKO045.0	Stink Creek, lower	2	2	YUKO195.0	Woodchopper Creek + 8.0	2	2
YUKO048.5	70 Mile - 2.0 km	2	1	YUKO197.0	Woodchopper Creek + 10	2	3
YUKO051.5	70 Mile + 0.5 km	2	2	YUKO199.0	Webber Creek, m. upper	2	2
YUKO056.0	70 Mile + 5.0 km	2	3	YUKO199.5	Webber Creek, m. lower*	2	0
YUKO057.5	Tatonduk - 3.0 km	2	1	YUKO200.5	Webber Creek, downriver	2	1
YUKO076.5	Montauk Bluff	3	2	YUKO205.5	Thanksgiving Creek	2	2
YUKO083.0	Trout Creek	2	2	YUKO208.5	Takoma Creek	3	0
YUKO088.0	Nation River - 5.0 km	2	2	YUKO210.5	Takoma Bluff, upriver	2	2
YUKO090.5	Nation River - 2.5 km	2	0	YUKO229.0	23 Mile	2	2
YUKO095.5	Nation River + 2.5 km	2	0	YUKO231.0	22 Mile	2	3
YUKO108.0	Butte Creek	2	0	YUKO233.0	21 Mile	1	0
YUKO117.0	Glenn Creek + 0.5 km	2	3	YUKO235.5	19 Mile	2	3
YUKO126.5	Bear Mtn, Middle lower	2	2	YUKO239.5	16 Mile	2	0
YUKO129.0	Bear Mtn, Lower End	2	0	YUKO243.2	13 Mile	3	4
YUKO138.0	Kandik upper	3	2	YUKO249.0	10 Mile	2	0
YUKO140.5	Kandik middle	2	2	YUKO250.0	9 Mile	2	2
YUKO148.0	Biederman Bluff, upper*	2	0	YUKO254.0	7 Mile	2	0
YUKO149.5	Biederman Bluff, middle	2	3				
YUKO154.0	Chester Bluff, upriver	2	3				

Table 3. Occupancy, breeding success, and productivity of American peregrine falcons along the Upper Yukon River, Alaska, 1973 – 2008.

Year ^a	Terr. Occupied	Pairs	Unpaired Birds	Pairs With Nestlings	Percent Successful	Nestlings	Nestlings/ Total Pair	Nestlings/ Succ. Pair
1973	12	11	1	6	55%	16	1.45	2.67
1975	12	12	0	9	75%	17	1.42	1.89
1977	14	12	2	10	83%	22	1.83	2.20
1978	19	16	3	12	75%	28	1.75	2.33
1979	20	20	0	15	75%	40	2.00	2.67
1980	21	19	2	17	89%	45	2.37	2.65
1981	21	18	3	17	94%	55	3.06	3.24
1982	26	24	2	16	67%	40	1.67	2.50
1983	27	27	0	22	81%	59	2.19	2.68
1984	28	25	3	21	84%	48	1.92	2.29
1985	27	26	1	16	62%	41	1.58	2.56
1986	28	28	0	17	61%	44	1.57	2.59
1987	33	32	1	26	81%	64	2.00	2.46
1988	34	34	0	25	74%	61	1.79	2.44
1989	36	33	3	23	70%	53	1.61	2.30
1990	36	35	1	31	89%	82	2.34	2.65
1991	36	34	2	26	76%	56	1.65	2.15
1992	40	35	5	18	51%	41	1.17	2.28
1993	41	40	1	30	75%	81	2.03	2.70
1994	43	42	1	26	62%	59	1.40	2.27
1995	46	43	3	31	72%	75	1.74	2.42
1996	45	41	4	26	63%	66	1.61	2.54
1997	47	44	3	27	61%	60	1.36	2.22
1998	46	45	8	34	76%	75	1.67	2.21
1999	48	44	9	29	66%	66	1.50	2.28
2000	47	45	9	17	38%	35	0.78	2.06
2001	48	48	4	22	46%	53	1.10	2.41
2002	51	50	3	33	66%	70	1.40	2.12
2003	50	48	5	27	56%	60	1.25	2.22
2004 ^b	52	52	2	17	44%	33	0.85	1.94
2005	50	48	5	31	65%	70	1.46	2.26
2006	47	46	8	28	61%	64	1.39	2.29
2007	50	49	8	31	63%	82	1.67	2.65
2008	52	50	9	35	70%	80	1.60	2.29

^aData were not collected in 1974 and 1976.

^bOnly 39 of 52 pairs were checked for success due to smoke from large forest fires in 2004.

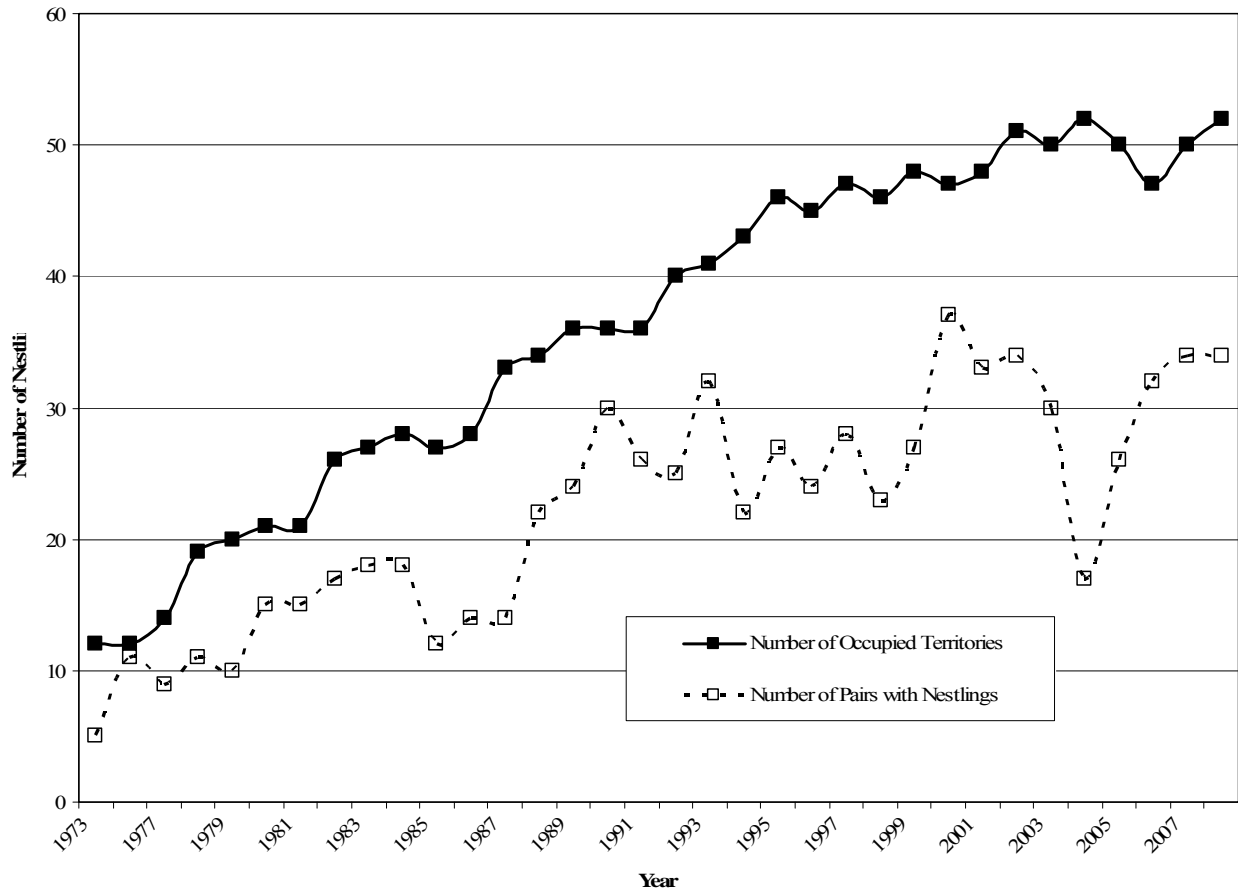


Figure 2. Number of occupied and successful (≥ 1 nestling) territories, American peregrine falcons, Upper Yukon River, Alaska 1973 – 2008. No surveys were conducted in 1974 or 1976. In 2004, only 39 of the 52 pairs were checked for breeding success and productivity due to smoke from large forest fires.

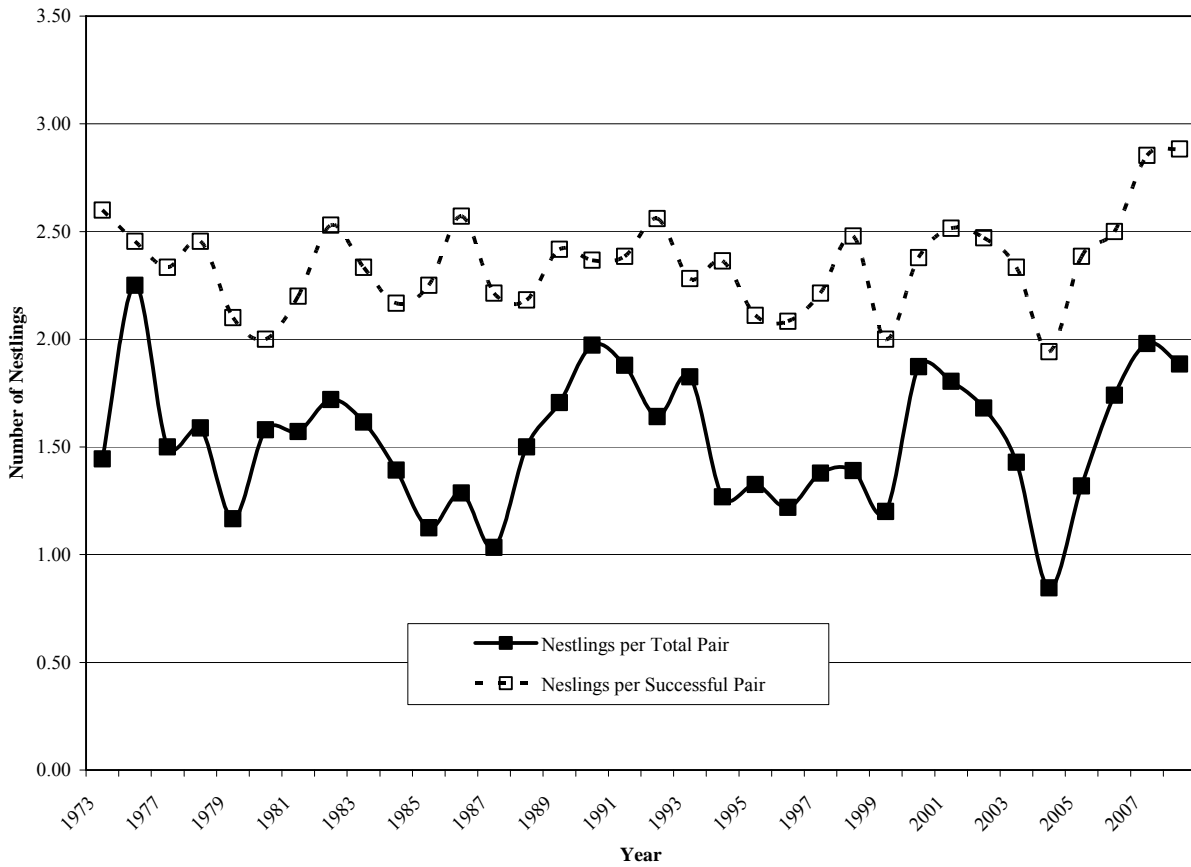


Figure 3. Nestlings per total pair and nestlings per successful pair, American peregrine falcons, Upper Yukon River, Alaska, 1973 – 2008. No surveys were conducted in 1974 or 1976. In 2004, only 39 of the 52 pairs were checked for success and productivity due to smoke from large forest fires.

Nesting Phenology

American peregrine falcons generally arrive in interior Alaska in late April and initiate courtship almost immediately. Egg-laying usually begins in early May and fledging occurs in late July or early August. Phenology in 2008 is presented in Table 5. The mean dates for nesting events in 2008 were approximately the same as the mean for previous years in the study period, 1973 – 2007 (Ambrose and Florian 2003, Guldager et al. 2005, Guldager et al. 2006, Flamme et al. 2007).

Table 4. Nesting phenology, American peregrine falcons, Upper Yukon River, Alaska, 2008.

Event	Mean	Range
Arrive Area	Mid to Late April	?
First Egg	10 May	6 May – 14 May
Start Incubation	17 May	13 May – 21 June
Hatch	19 June	15 June – 23 July
Fledged	29 July	25 July – 2 August
Leave Area	Early to Mid September	?

Discussion

Local American peregrine falcon populations in interior Alaska probably began to decline soon after the use of DDT became widespread in the 1950s, and subsequently began to rebound following the United States restrictions on DDT in 1972. The upper Yukon River population has increased steadily from 11 pairs in 1973 to a high of 52 pairs in 2004 and 2008. From 1973 to 1985, when density was the lowest in the study area, most occupied territories produced nestlings. In subsequent years as the number of occupied territories steadily increased, a lower percentage of the population has produced nestlings, though the number of pairs with nestlings and the total number of nestlings produced in the study area continued to increase (Figure 2). This lower proportion of successful pairs may be attributable to increased competition for resources. The number of nestlings per successful pair also showed no significant change from 1973 – 2008 (Figure 3), indicating no density effect on those pairs able to successfully fledge young. The population appears to be stabilizing, and a lower percentage of pairs are producing nestlings.

The upper Yukon River study area has many potential nesting territories of varying quality. Between 1973 and 2008, the number of pairs nesting along the upper Yukon River has been steadily increasing and appears to be stabilizing, although the percentage of successful pairs has been declining in recent years. As the population increased within the study area, pairs began to nest closer to each other and competition between pairs has increased. In 2008, four new territories were established on cliffs not previously used by peregrines in over 30 years of observations. Pairs of peregrines occupied new territories on Simon Bluff (YUKO 34.0), Upper Biederman Bluff (YUKO 148.0), Woodchopper + 2 km (YUKO 189.0) and Webber Creek-Middle (YUKO 199.5). None of the pairs at these 4 new territories produced nestlings.

As the population continues to grow, it will be important to follow the success of all territories, including those with a long history of use as well as those with little history of use. The occupancy and success at sites outside of the study area, such as along the Charley, Kandik and Nation rivers or those some distance from any river, will provide additional information on indication of habitat saturation.

Intensive surveys for American peregrine falcons in interior Alaska were not conducted prior to the introduction and use of DDT in the late 1940s. As a result, little is known about nesting densities, breeding success, and productivity of a healthy American peregrine falcon population. With continued surveys of this study area, we have the opportunity to better understand the breeding biology of a recovered population of American peregrine falcons.

Research Recommendations

1. Continue to annually monitor territory occupancy, breeding success, and productivity of American peregrine falcons along the upper Yukon River.
2. Continue to collect addled eggs, nestling feathers, and adult feathers for contaminants monitoring, specifically for monitoring mercury contamination.

3. Conduct surveys in habitats that are in close proximity to the upper Yukon River study area (e.g. Nation, Kandik and Charley Rivers) every 3-5 years. As the population continues to increase, birds may begin to use more sub-optimal habitat.
4. Develop a protocol for measuring adult survivorship using photos to identify individuals. Mercury contamination may first affect adult survivorship.
5. Continue to modify and improve the Microsoft Access American peregrine falcon database for historic and ongoing data collection.
6. Populate the Microsoft Access American peregrine falcon database with digital historic data including nest cards, photographs of territories, maps and field notes 1975 – 2008.
7. Continue to collect shed adult feathers and nestling feathers, egg-shell fragments and buccal swabs (Handel et al. 2006) from nestlings for genetic analyses.
8. Develop a series of photographs to document the development of wild American peregrine falcon nestlings along the upper Yukon River each day from hatch until fledging, for more accurate aging of nestlings.
9. Develop a spreadsheet to track which eyries have been observed during survey when traveling upriver and downriver.
10. Develop a spreadsheet to record locations of shallow water, good viewing areas for each eyrie, good camping spots for eyrie viewing and appropriate times of day for viewing each eyrie so lighting does not impede observations.

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Appendix I. Breeding Status Terminology for Raptor Observations

1. Unoccupied:

A nesting territory where no bird showing an affinity for the territory during the breeding season was observed (investigators must spend a minimum of 4 hours at the territory during the incubation period to make this determination).

2. Occupancy Unknown:

A nesting territory where no bird showing an affinity for the territory during the breeding season was observed but investigators spent less than 4 hours at the territory during the incubation period.

3. Occupied--Non-breeding:

A nesting territory where one or two birds showing an affinity for the nesting territory during the breeding season were observed but no eggs were laid (note: this category requires confirmation that no eggs were laid, therefore only those nests that were frequently observed can be assigned to this category).

4. Occupied--Breeding:

An occupied nesting territory where eggs were laid (evidence includes young in nest, eggs or eggshells, or adults seen incubating) but where final breeding success was not determined.

5. Occupied--Unsuccessful Breeding:

An occupied nesting territory where breeding was attempted but where no young reached 80% of its fledging age (for example, eggs destroyed or otherwise lost, eggs failed to hatch, or young hatched but died prior to fledging).

6. Occupied--Successful Breeding:

An occupied nesting territory where one or more young reached 80% of its fledging age.

7. Occupied--Breeding Status Unknown:

An occupied nesting territory where breeding or non-breeding could not be determined.

8. Occupied--Breeding Status Unknown, No Young Fledged:

An occupied nesting territory where breeding or non-breeding could not be determined but it was certain that no young fledged.

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